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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/033,549
Filing Date: December 27, 2001
Appellant(s): POLYNKIN ET AL.

David Alberti
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 3, 2005 appealing from the Office action mailed May 4, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct. The examiner notes that time-division-multiplexed versus concurrent operation is also described at p. 2 lines 17-29 of the specification.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

Claims 1-7, 32, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stafford (US 5504575) in view of Tobias (US 5483335).

Stafford discloses an apparatus (fig. 3) including an input port (e.g. via slit **60**) providing a multi-wavelength optical signal; a wavelength-disperser **80** that separates the multi-wavelength optical signal by wavelength into multiple spectral channels having a predetermined relative arrangement; an array of beam-manipulating elements **93** positioned to correspond with the spectral channels; and an optical detector **100**. The beam-manipulating elements are individually controllable so as to be capable of directing spectral channels into the detector concurrently, and capable of directing spectral channels into the detector in a time-division-multiplexed sequence. Note the description at col. 6 line 59 – col. 7 line 3, in which various groups of channels are directed into the detector sequentially, while each channel of a given directed group is directed concurrently into the detector.

Stafford does not disclose an array of optical detectors including a plurality of detectors each corresponding to a unique spectral channel. However, it is already known in the art to use an individual detector for each spectral channel. Tobias teaches that array detectors are advantageous over single detectors for spectroscopy because they enable analysis of multiple wavelengths simultaneously instead of sequentially, and have an increased signal-to-noise ratio (col. 4 lines 40-50). It is further noted that the Stafford device is applicable to visible wavelengths (abstract; col. 2 lines 8-10), and that Tobias teaches that array detectors for the visible spectrum are effective and relatively cheap (col. 1 lines 50-59). Thus it would have been obvious to a skilled person at the time the invention was made to modify the Stafford apparatus by including additional photodetectors in an array in order to achieve the advantages taught by

Tobias. The modified Stafford apparatus satisfies claim 1, and the method of using it satisfies claim 32.

As to claims 2, 4, and 35, in one embodiment the beam-manipulating elements **93** are rotatable micromirrors (col. 3 line 67 – col. 4 line 15; claims 1 and 6). As to claim 3, the micromirror devices (DMDs) used by Stafford and disclosed in Hornbeck (US 5061049) are micromachined silicon mirrors.

As to claim 5, the micromirrors are used as shutters. As to claim 6, the shutters may alternatively be liquid crystal shutter elements (col. 4 lines 46-49; claims 1 and 7).

Regarding claim 7, the dispersing element **80** is a prism in the exemplary embodiment, but may alternatively be a transmission grating (col. 3 lines 61-63).

As to claim 8, Stafford teaches that the detector may be any conventional spectrometer detector. All the recited types of photodetectors are conventional and widely used. It would have been obvious to a skilled person to use any suitable conventional photodetector array in the Stafford device since a conventional photodetector would be less expensive and easier to replace than a rare or exotic type of photodetector.

As to claim 9, it would have been obvious to a skilled person to further modify the above combination by incorporating an input optical fiber with a fiber collimator at the input port, since this would advantageously enable processing of signals from a remote optical source. As to claim 10, it would further have been obvious to use a single mode fiber in particular, since this would reduce the undesirable modal dispersion effects associated with multimode fibers.

Regarding claim 11, Stafford does not disclose a beam focuser which focuses the spectral channels into corresponding focused spots. However, it would have been obvious to a person

having ordinary skill in the art to provide an array of lenses spaced congruently to the array of fibers **92** in the fig. 3 device in order to maximize the efficiency with which light is coupled into the respective fibers. This would be beneficial since in a spectrometry application it is generally useful to accept as much of the original spectrum as possible without distorting it by unnecessary losses.

Claims 18-29, 31 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stafford (US 5504575) in view of Tobias (US 5483335) as applied above, further in view of Braun et al. (US 6177992).

With regard to claims 18 and 36, Stafford does not describe a beam focuser that focuses the dispersed optical beams onto the corresponding beam-manipulating elements **93**. However, the use of lenses to couple light into optical fibers is routine in the art. It would have been obvious to a person having ordinary skill in the art to provide lenses to focus the respective channels onto the input ends of the corresponding fibers **92** (each of which ultimately conducts the respective channel to its beam-manipulating element) since it is well known that the efficiency of coupling light into an optical fiber is extremely sensitive to misalignment, and since the core diameter of an optical fiber is usually much smaller than the outer diameter of the fiber. It would be especially important to maximize the power coupled into the fiber for each channel when the device is used to measure the relative intensity of the channels.

Stafford also does not disclose a polarization separator or rotator as required by claims 18 and 36. Braun discloses a general technique for handling signals with orthogonal polarizations as described above. It is noted that while a prism may not be as polarization-sensitive as a

grating, it would still be important to have the polarization components properly aligned when passing through LCD shutters, which are used in an alternative embodiment of Stafford and which are typically polarization-sensitive. In another alternative embodiment, a grating may be used instead of the prism as noted above. Therefore the technique taught by Braun would be useful in achieving proper orientation of the polarization components of an input signal in the Stafford device. Accordingly it would have been obvious to a skilled person to provide a polarization splitter, a polarization rotator, and an additional spatial light modulator array **90** in the above-proposed Stafford/Tobias combination in order to enable the handling of signals with orthogonal polarizations. The proposed modification and its method of use would have met the limitations of claims 18-27, 29 and 36.

As to claim 28, it would have been obvious to include a fiber with a fiber collimator as argued above with respect to claim 9.

As to claim 31, it would have been obvious to use any of the recited types of photodetectors as argued above with respect to claim 8.

Claims 12-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stafford (US 5504575) in view of Tobias (US 5483335) as applied above, further in view of Saunderson (US 3090278).

As to claim 12, Stafford does not disclose a reference signal and a reference position-sensing element. However, it is well known that optical elements such as the prism **80** in Stafford need to be precisely aligned for proper operation and that ambient conditions (e.g.

temperature changes or vibrations) can cause misalignment. Stafford does not mention any means for correcting and maintaining the alignment of prism **80**.

Saunderson discloses a spectrometer system. In the fig. 2 embodiment, a reference signal ("monitor radiation") of a particular wavelength is applied to the input port along with other wavelength signals (see also claim 1). The reference signal is diffracted from the grating **28** and propagates to a position-sensing element which includes elements **94-110**. The photomultiplier tubes **102** and **104** generate drive signals for a servo motor **48** that controls the alignment of the grating (fig. 1). The drive signals are representative of the grating position as described at col. 3 lines 29-51.

The overall alignment technique taught by Saunderson is applicable to the spectrometer disclosed in fig. 3 of Stafford. Thus it would have been obvious to a skilled person to further modify the Stafford/Tobias combination in the manner suggested by Saunderson by providing a reference wavelength signal, a position detector for that signal, and a servo device responsive to the position detector for controlling the position of prism **80** in order to maintain correct alignment of the prism with respect to the other components of the arrangement. The proposed further modification would have met the limitations of claims 12, 13, 15, and 17.

As to claim 14, it would have been obvious to a skilled person to further modify the above combination by incorporating an input optical fiber with a fiber collimator at the input port, since this would advantageously enable processing of signals from a remote optical source. An optical combiner would inherently be included in the proposed modification since there must be some way of getting the reference wavelength signal into the fiber.

As to claim 16, since the reference wavelength signal would be refracted from prism **80** along with all the other input wavelength signals, and since the other signals are already incident on the beam-manipulating elements **93**, it would have been obvious to a skilled person to locate the position-sensing element with the beam-manipulating elements **93** for simplicity. It is noted that Saunderson places the position-sensing elements in the same array as the exit slits (such as **34** in fig. 1), and the exit slits essentially correspond to the beam-manipulating elements **93** of Stafford. Moreover, although Saunderson teaches adjustment of the disperser position, a skilled person would have understood that the disperser could be fixed while the slit / PMT array is moved. Thus in the combination proposed above it would have been obvious to such a person to fix the grating position while rotating the element array **90**. One motivation for this alternative arrangement is that the array **90** would be more susceptible than the prism to misalignments resulting from temperature changes.

(10) Response to Argument

A. Claims 1-11, 32, and 35 are Patentable over Stafford in View of Tobias

1. The Stafford And Tobias References

Appellant's brief summary of these references is not disputed.

2. There Is No Suggestion Or Motivation For The Proposed Combination Of Stafford In View Of Tobias, And The Proposed Combination Is Improper

(a) The Prior Art References When Considered As A Whole Teach Away From The Proposed Combination

The argument at p. 8 of the Brief asserts that an express teaching of a single detector in Stafford is equivalent to teaching away from an array type detector. The examiner disagrees with this assertion. At most, the absence of description of an array type detector in Stafford amounts to *not* teaching *toward* an array type detector. It is not the same as *teaching away from* such detectors. Stafford does not actually state that an array detector would be disadvantageous or ineffective, and there is no discussion in that reference which specifically excludes the use of an array of detectors.

Appellant argues that Stafford prefers a single detector with a linear response, and that there is no objective evidence that the teachings of Stafford could not be applied to compensate for deviation from linearity for an array of detectors as was previously asserted by the examiner. Again the examiner disagrees and submits that an array of detectors would be expected to include many detectors of the same type and each detector would have the same nonlinearity in its response, so that the compensation required for a single detector would also be required for each of the other detectors in the array. Alternatively, even if it is assumed that each detector has a different nonlinearity, the same process for assessing the nonlinearity and determining a suitable compensation would be applied in turn to each detector of the array.

Appellant argues (Brief, p. 9) that Stafford teaches the use of arrays in some parts of the device (e.g. an array of micromirrors and an array of fibers), but does not teach or suggest that an array of detectors would be an acceptable replacement for a single detector, and therefore contradicts the assertions of applicability and desirability of the proposed combination. The examiner does not agree. The micromirrors (or shutters **93**) and the fibers **92** are necessarily in arrays because of the nature of the device. Each shutter and each fiber corresponds to a different

spaced-apart beam from the dispersed spectrum, and a single shutter or single fiber would not be capable of intercepting all those beams. The use of arrays for other components does not preclude the use of an array of detectors. In the examiner's view, it further suggests the desirability of an array of detectors because using an array of detectors corresponding to the respective positions of the fibers would eliminate the need to provide separate focusing means to direct the light exiting each fiber onto a single detector.

Appellant's argument that Tobias teaches away from using array detectors in these types of optical devices is not persuasive. The argument dwells on various reasons why an array of detectors is not preferred for use in the Tobias inventions. The examiner emphasizes again that Tobias is not the primary reference being relied upon in the obviousness rejection. The rejection does not propose bodily incorporating any part of the Tobias inventions into the Stafford device. Tobias is being relied upon merely for its express teachings of the advantages of array detectors relative to single detectors. These advantages are known generally to persons of ordinary skill in the art. The expressly disclosed beneficial properties of array detectors are not diminished just because Tobias opts not to make use of them. Furthermore, the shortcomings of array detectors referred to by appellant (Tobias col. 1 lines 60-67) pertain to detectors used for the near- and mid-infrared region of the spectrum. The immediately preceding paragraph (Tobias col. 1 lines 53-61) teaches that array detectors are quite practical for the visible portion of the spectrum. Stafford specifically teaches that his device can be used to analyze visible light (col. 2 lines 8-9).

Appellant argues (Brief, pp. 10-11) that Tobias teaches away from using array detectors to perform both multiplexed and concurrent detection. Again, the appellant refers to specific aspects of the Tobias inventions which are not being relied upon for the obviousness rejection.

The fact that Tobias chooses to do things another way does not invalidate the expressly disclosed advantages of array detectors. It does not matter whether the specific Tobias inventions do not perform both multiplexed and concurrent detection. The Stafford device, which is the one to be modified according to the rejection, does perform multiplexed and concurrent detection.

(b) The Examiner Has Provided No Objective Evidence Of A Motivation To Combine The References

Appellant argues (Brief, pp. 11-12) that no evidence of motivation to combine the teachings of the references has been provided. However, such evidence is found at least in Tobias' teachings of the benefits of using an array of photodetectors. The repeated argument that the references teach away from the proposed combination has been refuted earlier in this Answer.

3. Stafford in View of Tobias Does Not Teach All Claim Limitations of the Claimed Invention

Appellant argues at pp. 13-14 of the Brief that, even if the proposed combination were made, it would not automatically provide a system that could perform both concurrent and sequential detection. The argument alleges that because the Stafford device uses a single detector, it cannot achieve detection of individual wavelengths concurrently; whereas the claimed invention is capable of doing so. Rather, Stafford requires post-processing software to distinguish individual wavelengths out of the sampled group of wavelengths. The examiner does not dispute this view of the Stafford device taken alone, but notes that the claims do not recite detection of individual wavelengths concurrently. In fact they do not recite detection at all; they

merely recite directing the spectral channels into an array of detectors. The Stafford device *modified in the manner proposed by the rejection* meets this requirement. Even if the claims did recite concurrent detection of individual wavelengths, the modified Stafford device would be able to perform this function as well.

Appellant's arguments spanning pp. 14-15 of the Brief are not directed to alleged missing limitations, but rather to operability or propriety of the combination. In response, the examiner incorporates the reasoning from the second paragraph under section *A.*2.(a) above. The argument that there is no objective evidence that the control components of Stafford could be modified to handle a system having plural detectors is not persuasive. It is noted that Stafford refers to using a processor **34** (which may be a microprocessor) to handle the signal from the detector **28** (col. 3 lines. 23-34), and teaches that this same processor also controls the plural cells of the spatial light modulator **20** (see e.g. fig. 1). Microprocessor technology is well developed. Thus a skilled person would reasonably expect to be able to purchase or design a microprocessor which could handle signals from more than one detector. Moreover, processors which handle signals from plural detectors are already known, as demonstrated (for example) by the previously cited Chen et al. reference (US 6249346).

B. Claims 18-29, 31, and 36 are Patentable over Stafford in View of Tobias and Braun

Appellant incorporates the arguments made with respect to the combination of Stafford and Tobias. Accordingly, the examiner incorporates the above reply to those arguments.

C. Claims 12-17 are Patentable over Stafford in View of Tobias and Saunderson

Appellant incorporates the arguments made with respect to the combination of Stafford and Tobias. Accordingly, the examiner incorporates the above reply to those arguments. Appellant further argues that Saunderson involves a servo system which goes against Tobias' teaching of elimination of moving parts. The examiner notes again that no mechanical parts of the Tobias invention are incorporated into the Stafford device in the rejection. Tobias' preference for no moving parts does not nullify the disclosed advantages of array-type detectors.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Mike Stahl MJS

December 19, 2005

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